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# UKDAP-Inclusive Digital Futures Project

# Module Learning Outcomes

Module B210: Basic E-Waste Management

| S/NO | Learning Outcome | Topic | Sub-topics | Duration |
|---|---|---|---|---|
| 1. | Understand the Regulatory Framework | Regulatory Framework | •Compliance and enforcement mechanisms<br>•Role of government and industry stakeholders | [3 Hrs] |
| 2. | Analyze the Social and Economic Implications | Social and Economic Implications | •Informal e-waste recycling sectors<br>•Case studies and real-world examples | [3 Hrs] |
| 3. | Evaluate Waste Recycling Techniques | E-Waste Recycling Techniques | •E-waste recycling processes and technologies<br>•Resource recovery from electronic waste<br>•Environmental benefits and challenges of recycling<br>•Best practices in e-waste recycling | [5 Hrs] |
| 4. | Comprehend the Collection and Management | Collection and Management | •E-waste collection methods and logistics<br>•Sorting and classification of e-waste<br>•Dismantling and component recovery<br>•Hazardous materials handling and disposal | [5 Hrs] |

**What is e-waste?**

an electronic device or gadget, at the end of its useful life

**What is e-waste management?**

the process of handling, collecting, disposing of, recycling,

and reusing electronic waste.

# Significance of E-waste Management



- Environmental Conservation
- Resource Protection
- Reducing Landfill Waste
- Economic Opportunities

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# REGULATORY FRAMEWORK

# Compliance and enforcement mechanisms

- E-Waste Management Regulations, 2013
- Extended Producer Responsibility (EPR) Regulations 2021
- Public Procurement and Disposal Acts
- Licensing Requirements
- National ICT Policy 2006

## Role of government

1. Policy Formulation and Regulation
2. Licensing and Oversight
3. Public Awareness Creation
4. Research and Development Support
5. Data Collection

# Role of industry stakeholders

**1. Manufacturers/Importers/Assemblers:**

- responsible for implementing extended producer responsibility (EPR) programs

**2. Recyclers:**

- dismantling electronic devices
- extracting valuable materials for reuse

## Learners' Activity

Discuss the following questions in groups and present to the class

1. What is the Journey of Kenya in drafting e-waste regulations in the Country
2. What are some of the Key take away points in the Regulations the Country has formulated in helping manage e-waste?
3. Highlight the achievements made by the Country in managing e-waste?
4. What do you like most from the steps the Country has taken in managing e-waste?

# Chapter Summary

E-waste, or electronic waste, consists of discarded electronic devices

In Kenya, e-waste generation has surged due to:

- technology adoption
- imported used electronics

The country has implemented regulations and policies

The government, stakeholders, and the public all play vital roles

## End of Chapter

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# SOCIAL AND ECONOMIC IMPLICATIONS

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# Informal e-waste recycling sectors

**Overview:**

This sector has grown significantly; supports many livelihoods.

But operates in unsafe conditions;

lacking protective gear and environmental controls

**Consequences:**

- **Occupational Health Risks**
- **Environmental Impact**
- **Child Labor**

# CASE STUDIES AND REAL-WORLD EXAMPLES



**Case Studies:**

1. East Africa Compliant Recycling (EACR)
2. Wetu
3. WEEE Center Nairobi

## Learners' activity

Conduct a community survey on technological consumption habits. Use the following questions to guide your survey:

1. When was the last time you got a new electronic gadget?
2. How long did you have the old electronic gadget?
3. What did you do with the old gadget?
4. Do you know how to recycle your electronic gadget?

- Discuss the responses in groups.

## Chapter Summary

- social and economic impacts of informal e-waste recycling
- health risks and environmental pollution

Collaborators:

East Africa Compliant Recycling (EACR),

Wetu; and

WEEE Center

Overall:

Appreciate: complexities | opportunities

## End of Chapter

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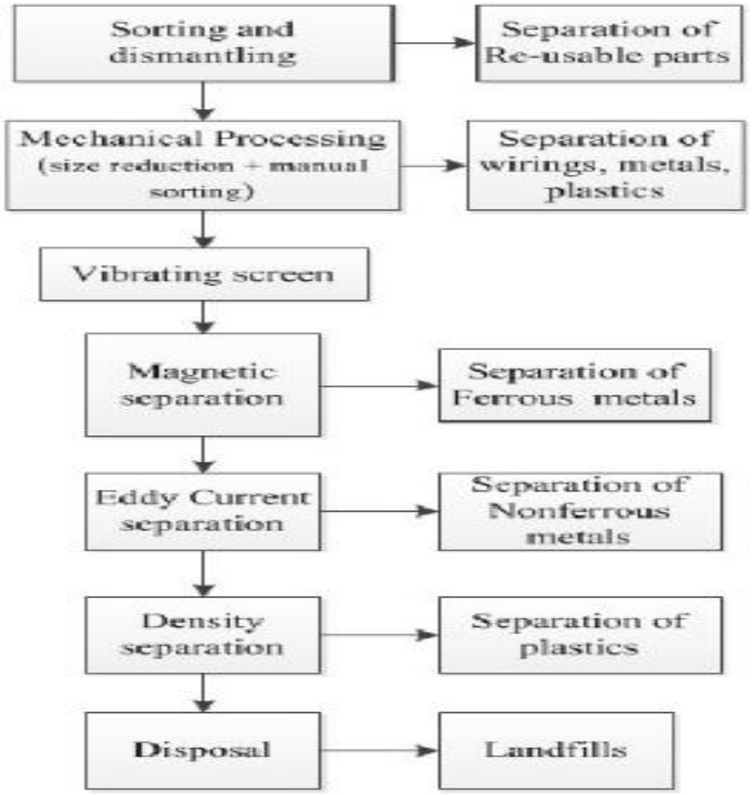
# E-WASTE RECYCLING TECHNIQUES

**Notable e-waste recycling techniques**:

- **Mechanical processing**:
  - ✓Physical breakdown
- **Hydrometallurgical processing**:
  - ✓using chemical solution
- **Pyro-metallurgical processing**:
  - ✓using high temperature.


Sorting and dismantling
Separation of Re-usable parts
Mechanical Processing (size reduction + manual sorting)
Separation of wirings, metals, plastics
Vibrating screen
Magnetic separation
Separation of Ferrous metals
Eddy Current separation
Separation of Nonferrous metals
Density separation
Separation of plastics
Disposal
Landfills

| Feature | Mechanical | Pyrometallurgical | Hydrometallurgical |
|---|---|---|---|
| Primary Tool | Physical Force / Magnets | Extreme Heat (Furnace) | Chemical Solutions (Acids) |
| Best For | Initial separation | Bulk base metal recovery | High-purity precious metals |
| Temp. Range | Ambient | 800°C – 1200°C | 25°C – 90°C |
| Environmental | Dust / Noise | Air emissions / GHGs | Liquid chemical waste |

## Processes and Technologies

- Collection and segregation
- Pre-processing
- Mechanical processing
- Chemical processing
- Metallurgical processing
- Plastic Recovery
- Glass recovery
- Circuit board processing
- Battery recycling
- Environmental control
- Quality control and testing
- Product re-use and refurbishment
- Final product manufacturing
- Certification and Compliance

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# Processes and Technologies Highlights

Collection & Processing | Recovery & Recycling | Compliance & Quality

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# Resource Recovery from Electronic Waste

Resource recovery reclaims valuable materials; and mitigates environmental impact.

- The recovery processes include:
  - ✓ Characterization of E-Waste
  - ✓ Collection and Segregation
  - ✓ Dismantling and Shredding
  - ✓ Precious Metal Recovery
  - ✓ Circuit Board Recycling
  - ✓ Plastic Recycling
  - ✓ Glass Recovery
  - ✓ Hazardous Material Management

# Environmental Benefits and Challenges of Recycling

## Benefits

- Resource Conservation
- Reduction in Energy Consumption
- Lower Greenhouse Gas Emissions
- Pollution Prevention
- Conservation of Rare Earth Elements
- Conservation of Rare Earth Elements

# Environmental Benefits and Challenges of Recycling

## Challenges

- Technological Obsolescence
- Lack of Awareness and Access
- Exportation | Importation of E-Waste

# Best Practices in Recycling

- Awareness and Education
- Collection Programs
- Data Management
- Environmentally Responsible Processing
- Circular Economy Initiatives
- International Agreements and Regulations
- Extended Producer Responsibility (EPR)

## Learners' Activity

Discuss the following questions with regards to e-waste management

1. What are the environmental benefits of recycling e-waste, and how do they contribute to sustainability?
2. How can public awareness and education play a pivotal role in improving e-waste recycling practices?
3. Describe the challenges associated with recycling e-waste, especially in the context of rapid technological obsolescence.
4. Explain the concept of "Extended Producer Responsibility (EPR)" and its significance in e-waste management.
5. What are the potential hazards of improper disposal of e-waste, particularly regarding data security and environmental pollution?

# Chapter Summary

**E-waste recycling**:

- ✓reclaims valuable materials from electronic devices
- ✓preserves resources
- ✓mitigates pollution
- ✓averts hazardous waste exposure

**Techniques:**

- ✓mechanical,
- ✓hydrometallurgical, and
- ✓pyro-metallurgical processing

Has: Benefits | Challenges | and there are BEST PRACTICES

## End of Chapter

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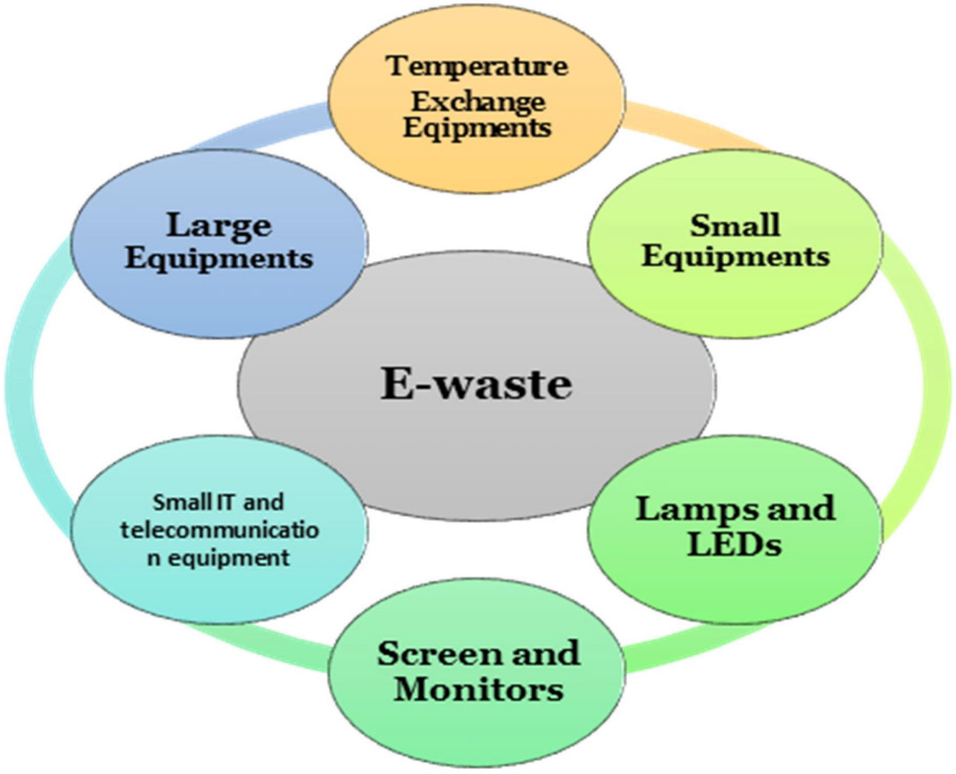
# E-WASTE COLLECTION AND MANAGEMENT


Temperature Exchange Eqipments
Large Equipments
Small Equipments
E-waste
Small IT and telecommunicatio n equipment
Lamps and LEDs
Screen and Monitors

# Key benefits of effective e-waste collection

- Protection of the environment
- Resource recovery
- Compliance with regulations
- Safety for workers
- Public participation

- Accessibility
- Economic benefits
- Reducing landfill waste
- Extending product lifespan
- International cooperation

# E-Waste Sorting and Classification:

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- Categorization by type
- Segregation of components
- Hazardous materials identification
- Reusability assessment
- Brand and model sorting
- Data destruction
- Size and weight classification
- Identification of rare materials
- Evaluation of repair-ability
- International harmonization
- Consumer education

# Benefits | E-Waste Sorting and Classification



- Efficient and safe recycling and treatment
- Prevention of environmental pollution
- Conservation of natural resources
- Economic benefits

# Dismantling and Component Recovery

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# Key aspects of e-waste dismantling and component recovery.

- Safe dismantling
- Handling a diverse range of devices
- Deconstruction techniques
- Component separation
- Battery removal
- Precious metal recovery
- Plastic recycling

- Circuit board extraction
- Reusability assessment
- Data destruction
- Environmental considerations
- Worker health and safety
- Technological advancements
- Adherence to regulations

# Hazardous Materials Handling and Disposal

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# Key aspects of hazardous materials handling and disposal in e-waste

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- Identifying hazardous materials
- Segregation
- Proper storage
- Safe handling practices
- Battery handling
- Decontamination procedures
- Hazardous waste labels
- Secure data destruction

- Transportation precautions
- Disposal regulations
- Recycling and recovery
- Certified e-waste recyclers
- Environmental impact assessment
- Public awareness
- Reporting and accountability

# Learners' Activity

1. Why is it crucial to collect and transport e-waste in a responsible and organized manner?
2. What are the potential consequences of improper collection and transportation?
3. Can you name some of the hazardous materials commonly found in e-waste, and why are they a concern for the environment and human health?
4. How do e-waste collection methods contribute to protecting the environment and reducing the impact on landfills?
5. What are some of the valuable materials that can be recovered from electronic devices through proper sorting and classification? How can these materials be reused or recycled?

# Chapter Summary

- Efficient e-waste collection and logistics
- Sorting and categorizing e-waste are pivotal processes
- Dismantling and component recovery are paramount
- The management of hazardous materials in e-waste is a process

# End of Chapter

# Brain Teaser Questions

- **Brain Teaser 1:** "I am taken from a mine, and shut up in a wooden case, from which I am never released, and yet I am used by almost every person. What am I?“

- **Brain Teaser 2:** "You see a boat filled with people. It has not sunk, but when you look again you don’t see a single person on the boat. Why?"

# Question?


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